

# Web 2.0 as an e-portfolio tool

Silvia Rodriguez-Donaire  
Department of Management  
Technical University of Catalonia  
Barcelona, Spain  
silvia.rodriguez-donaire@upc.edu

Beatriz Amante García  
Department of engineering projects  
Technical University of Catalonia  
Barcelona, Spain  
beatriz.amante@upc.edu

**Abstract—** The present article introduces the main qualitative and quantitative results obtained in a pilot study of e-portfolio implementation in two different subjects offered in the Technical University of Catalonia (Universitat Politècnica de Catalunya, UPC). Specifically, this teaching innovation took place within the Technical Industrial and Aeronautics Engineering School (ETSEIAT) curricula. Our results indicate that the e-portfolio can be considered: 1) a complementary tool for student's assessment and 2) an ideal follow-up device for monitoring student development (both generic and specific) throughout their degree studies. The useful data compiled allows us to draw general conclusions and therefore, consider its implementation in the second cycle of Industrial Organization (IO) Engineering as well as the additional degrees taught at the UPC.

**Keywords-** *student skill assessment, collaborative tools, e-portfolio, Web2.0, European Higher Education Area (EHEA), teaching innovation.*

## I. INTRODUCTION

The portfolio/e-portfolio is widely accepted as a tool for improving the teaching quality as well as facilitating rapid learning of the students. We can divide the e-portfolios into two large groups, categorizing them as a: 1) “complementary tool for student assessment” and 2) “complementary tool for student reflection”.

Highly renown authors [1-4], use the e-portfolio as a “complementary tool for student reflection”, in which students, at the conclusion of each topic or recompilation of class assignments, evaluate their learning progress and, in addition, assess the way in which they have been able to benefit from all of the steps or relevant actions performed (by professor and students alike) in order to attain the degree of learning that they have.

The use of e-portfolios, as a 'purposeful aggregation of digital items' [4], can meet the needs of the student community by encouraging reflection, the recording of experiences and achievements, and personal development planning (PDP). The use of e-portfolios also promotes inclusiveness in learning as it provides students with the opportunity to articulate their aspirations and take the first steps along the pathway of lifelong learning.

-With reference to the classification as “Complementary tool for student assessment”, one can find a selection of highly informative publications [5-11] in which the main focus is on content learning and in addition, use the e-portfolio as a

knowledge-gaining tool or virtual classroom platform [7], are geared towards the students themselves and their rate comprehension.

The results of this study [12] suggest that both teachers and students find the e-portfolio process necessary in vocational education. The process was reported to be particularly helpful in putting theoretical knowledge to use, making use of various types of evidence for student learning, encouraging continuous student development, and actively using self-evaluation and information as well as computer technologies in teaching.

It has also been demonstrated that the use of virtual environments such as the Web 2.0 or social networks [8], gives rise to an increase in student motivation, leading to [13] an increase in the level of participation and ultimately improved learning.

In [8,14] this approach is also presented as an excellent tool for developing generic skills. Nevertheless, the manner in which such skills are to be evaluated is not specified, but rather, is made possible via the e-portfolio. Lastly, in [9] the question is raised on how and when to introduce e-portfolios within a program, as a skill-based learning tool.

In recent years, as we mentioned previously, in addition to the acquisition of knowledge, students are faced with the incorporation of transversal skills into their sphere of learning. [14]. This skill-based model has been defined by various institutes or universities upon the development of new study plans in Bologna. It's chief objectives are to produce professionals that are equipped enough to face situations of the real world as a result of having acquired not only the knowledge of the subject content but also the transversal skills necessary for its application. Hence, centers of university education, following studies and projects such as Tuning [15], should be able to assert that the skills required for a given degree have been attained.

In this particular study, in response to the question regarding the need for skill evaluation tools, we propose and validate the possibility of assessing the different skills (generic and transversal) by way of the e-portfolio. For this we initially measured the degree of feasibility of the application of this tool for the evaluation of those skills that have been outlined established by us (in the university degrees awarded by ETSEIAT there are a total of eight skills: self-study, competent use of information technology resources, “*synthesis and analysis*”, “*innovation and creativity*”, “*sustainability and social responsibility*”, “*oral and written communication*”, “*use of the English language and teamwork*”).

Previous investigations have focused on the evaluation or gauging of specific skills. Such is the case of [16], which is centered on the assessment of English language usage. Our aim, however, is to demonstrate that a registry can be maintained of all the skills required for a given degree and can then be evaluated through the use of the student e-portfolio.

In this article we therefore present the following points:

- Description of the pilot experience executed in two different subjects of the second cycle of “Ingeniería en Organización Industrial” of the ETSEIAT (UPC).
- Show the results obtained following the evaluation of 69 e-portfolios of students via rubrics that examine the 8 skills of the UPC and more specifically, the ETSEIAT institute.
- Show the perception this is held by professors of the UPC (those who use such collaborative resources in the classroom), of skill evaluation via collaborative tools; Likewise, the perception of the students participating in this scheme will also be presented.
- Lastly, we will discuss the results and will outline the future steps that we aim to take.

## II. WHAT IS AN E-POTFOLIO?

The idea of utilizing e-portfolios actually was derived from artists in the light of their need for displaying their work: photographs, paintings, sculptures etc. The concept was then adopted by graphic designers, computer programmers etc. Now this idea has become increasingly more widespread throughout all academic degrees. Presently, teachers themselves create their own e-portfolios, using them as evaluation tools to ensure consistent teaching quality. [17-19], demonstrated that it could also be a tool for compiling evidence of learning throughout each academic year.

We can define the e-portfolio as a collection of evidence of the different learning processes: namely instruction, work experience, life experiences and even personal interests.

This collective of deliverables allows us to evidence the knowledge acquired over a given time period. The e-portfolio is able to compile together individual or collective experiences, enriching itself over the course of time. It can be produced in written document or electronic format; both of which being comprised of writings, images, etc. that enable us to present our professional and personal experience. The electronic format compiles the groups of deliverables of the student, as with their reflections, through the use of collaborative tools made available through the internet.

A e-portfolio is essentially an instrument with an aim of selecting samples of deliverables or evidences which attests to the accomplishment of personal and professional goals, which are organized and presented in a specific manner. Likewise, evidence can present reflections on each one of the deliverables given [17].

The most outstanding change that we can observe with the e-portfolio as compared to the traditional method is the relative ease with which we can publish the electronically organized content and / or evidence on the internet. Furthermore, such content comes with a personalized design, and in addition allows us to share our ideas with other on-line users throughout the period of learning / reflection.

The arrival of and use of collaborative environments and internet platforms that place great emphasis on the exchange of information among users, (e.g. BSCW, Google Docs, Google Sites, Moodle, among others) has been a new medium to be considered as a complementary element for the determination of new learning methodologies. In addition, this medium allows for additional support to be given to the practice of university level teaching, not to mention Web 2.0 and full utilization of all its advantages.

All of the mentioned environments foment accessibility, exchange and creation of new knowledge, together with increased productivity and flexibility in collaborative tasks [20], [21].

## III. METHODOLOGY

The execution of the pilot experience is founded on two objectives:

*1.-Demonstrate that the e-portfolio can serve as a tool for skill evaluation.*

*2.-Demonstrate whether is it possible to follow up on student skill development, be they generic or specific, throughout the degree programs.*

As a result this can be summarised as the need, by way of the e-portfolio, for “evaluating (i.e measuring) the development of the eight transversal skills as established by the “Escola Superior d’Enginyeria Industrial i Aeronàutica de Terrassa” (ETSEIAT) of the Universitat Politècnica de Catalunya (UPC) for the various degrees in engineering that are offered. The same applies to the evaluation of generic skills (knowledge unique to a specific degree).

In order for such objectives to be attained, we pose an activity to be carried out during a quadrimester in two subjects (“Proyectos” y “MQ2”) simultaneously. Furthermore, considering that the students are in their final years and that, as a result, after these subjects most of them will have to face the real professional world, it was decided that we would perform all activities in English. This in turn enabled us to also assess the general competence level of the third language of the region, which in our case, is English.

The first phase consisted of the establishment of content objectives for those subjects to be selected to undergo the development process of this activity. Likewise, we determined as to how we would represent the work performed in the e-portfolio of the two subjects in which we plan to implement this pilot study. We designed two e-portfolios for the subjects (see Fig. 1), in which the different sections required of the students will be included. In these subject e-portfolios, some

sections can be found which use an example format, whilst others comprise an explanation of the type of work that is expected of the student based on the course content.

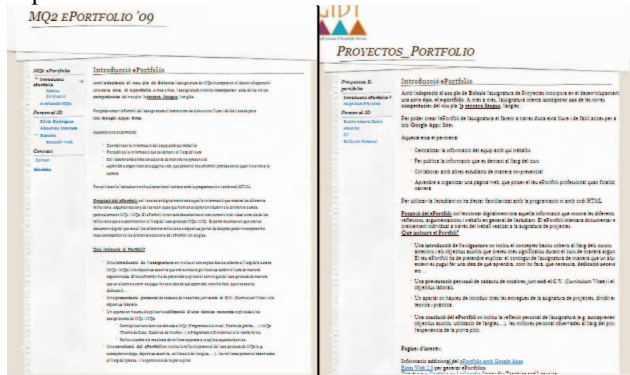


Figure 1. Example of e-portfolio Project and MQ2.

The design of the e-portfolio consisted of the following parts or sections.

- A **personal section** in which a brief description of the student and their professional aspirations were given, and included their Curriculum Vitae and cover letter. This was intended to cover the needs of the student (generate an on-line C.V.), whilst contemplating objectives and professional plans for the future. The objective of this section is the development of critical thought through posing a set of guidelines that could allow for the student's professional interests to be achieved.
  - An **introductory section of the subject** which includes a brief description of the same, detailed in the words of the students themselves. This also includes the basic concepts covered throughout the subject, the objectives achieved, the time devoted to the development of the different activities proposed for the subject, as well as the production of the e-portfolio.
- The rationale for this section was essentially to enable students to analyze, synthesize and develop the theoretical knowledge obtained in the subjects.
- A **practical application** section consisting of the implementation of the concepts and / or methods imparted in a given subject. Likewise it consists of a posterior period of reflection on the expected outcomes. Each student had to design and implement his or her own personal case study based on their professional experience, as well as the knowledge acquired in the subject. The aim of this section is to motivate the students by means of providing an opportunity for them to see the applicability of the different techniques or methods learned in class (concerning the projects), one is carried out which is related to a topic which proposed by the professor and varies annually. Students apply methodologies that assist them, for example, in selecting the best technical systems to use at each given moment and as well as for specific projects. We feel that this exercise facilitates an added value in the learning of the techniques covered in the subject.

We are now centering our attention on the objectives of the taxonomy of Bloom[22]. This system states that the student must carry out an overview of their knowledge (concepts) and what they are to interpret and apply within a professional context. Moreover they must determine the objectives of the case study in which improvements in technique and methodology have been detected, apply the technique and then make predictions as to what the end result or expected outcome will be.

The remaining section is one in which the student has the chance to reflect and draw conclusions on all that they have acquired from the experience.

- The **conclusions** section which includes a brief reflection on the usefulness of these tools, the most outstanding and not-so-outstanding aspects of the e-portfolio, together with issues such as what the plan for self-improvement will be, in order to better tackle future subjects. The goal is to develop a critical analysis of the knowledge acquisition process during the entire period in which the e-portfolio is being compiled; detecting any inadequacies of the tool and of the methodology applied.

In Fig. 2, we can see a couple of examples of a student e-portfolio.

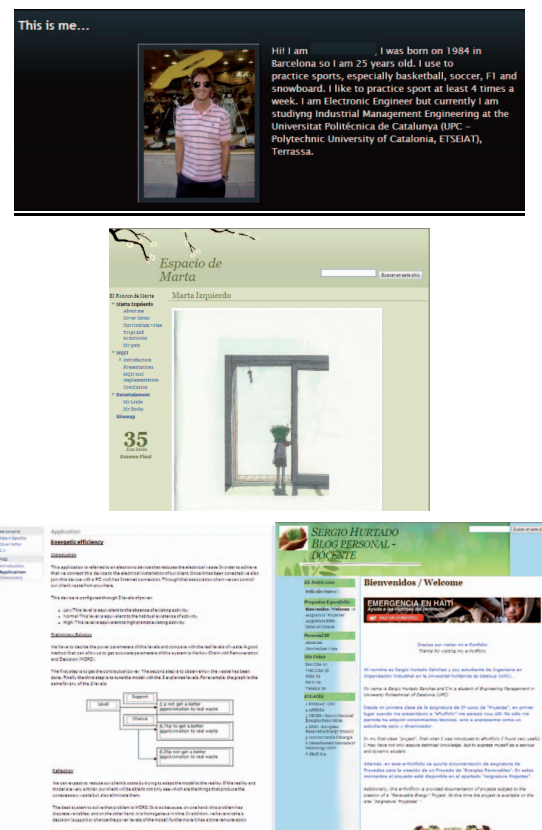


Figure 2. Examples of student e-portfolio.

Once the different sections and objectives of each have been defined, we construct an evaluation chart of the eight skills that we wish to evaluate (see Table 1, extract of the evaluation chart).

TABLE I. EXTRACT OF THE SKILL EVALUATION RUBRIC

		A	B	C	D
Oral Communication	Clarity of ideas	The contents of the video-presentation are properly understood	The contents of the video-presentation are almost properly understood	The contents of the video-presentation are not properly understood	The contents of the video-presentation are not understood at all
Oral Communication	Presentation exposition	Students don't read the presentation and add information to the slides presented with examples	Students don't read the presentation too much (30%) and add information to the slides presented with some examples	Students don't read the presentation too much (50%) and add information to the slides presented without examples	Students read the presentation a lot and don't add information to the slides presented.
Oral Communication	Outline	I can prepare a clear outline of the video-presentation, including the introduction, development and conclusion, keeping the audience and the purpose of the talk in mind	I can prepare a outline of the video-presentation, including the introduction, development and conclusion, but not keeping the purpose of the talk in mind	I can prepare a outline of the video-presentation, but not keeping the purpose of the talk in mind	I cannot prepare a outline of the video-presentation neither keeping the purpose of the talk in mind
Oral Communication	Answer coherence	I can answer questions clearly and precisely that can be followed without difficulty most of the time	I can answer quite a lot of the questions that can be followed without many difficulty most of the time	I can answer some of the questions that can be followed without many difficulty most of the time	I cannot answer questions and that cannot be followed without many difficulty most of the time
Collaboration	Do you think you will use the multimedia skills with your colleges	Definitely will not	Probably will not	Probably will	Definitely will

Lastly, in order to observe its applicability in the implantation of a full degree, we create a survey for the professors of the ETSEIAT, which enables us to have a clear vision of the professors' thoughts and their applicability. Likewise, the students who participated in the activity were also requested to share their views.

#### IV. DISCUSSION

In this section we present the results of the two surveys that were handed to the students of the two subjects plus all of the professors of the ETSEIAT Center.

The teachers survey; made up of 50 questions, was sent to the distribution list of the entire teaching body of ETSEIAT.

The aim of this initiative was to determine the number of professors who would either be willing to use the e-portfolio or who currently use collaborative tools for the evaluation of generic skills. Of the total number of professors of the centre, a total of 40 participated, representing a quarter of the ETSEIAT (university professor) personnel.

Through an analysis of the results we can draw the conclusion that 67% of the interviewee's don't use on-line collaborative tools in class. This result could be possibly

explained by the fact that 59% of the professors surveyed were over the age of 40.

If we now focus on the sample of professors, the use of collaborative tools (e.g. Wikis, BSCW, google sites and others), to further enhance the student learning process, the most widely used collaborative environment used nowadays is Google Sites. This finding subsequently lead to our deciding to use the same tool, and thus carry out a practical application of the activity. We concluded that if this tool becomes more widely used today, it will be precisely the one that requires the least amount of effort for the implementation and evaluation of transversal skills in the future.

According to the professors, 92% of the students feel that they are satisfied with the use of collaborative environments or activities.

Another important point to consider is the ownership of the student of collaborative environment. According to the sample of professors that utilize such environments for the betterment of the learning process, in 90% of such cases the students have ownership.

This was another of the reasons as to why Google sites was seen as a good option for this activity, in that the students themselves would be the owners within this setting and furthermore, will be able to continue this practice throughout their post university career.

Concerning the question as to whether or not we consider such a learning environment to be useful for the development of generic skills in students, 77% were in agreement (i.e. those who replied 'Strongly agree' and 'agree') whilst 69% demonstrated the same in the case of the specific skills.

Judging from these results, it is thought to be an excellent tool for skill assessment and monitoring. Moreover, 100% of the professors believe that Google Sites can become a good skill development tool via the implementation of the e-portfolio. 50% of them who had tested this tool in their classes felt that 100% of their students found the experience to be very positive.

It is fundamental that the ETSEIAT centre be committed to teaching innovation; understanding that it has already received various awards of this nature in this field. For this reason we view these results as a very motivating for the collective of teachers.

The survey geared towards the students given at the end of the activity differed from that of the teachers in that it was circulated voluntarily. A total of 68 students of the two courses gave their opinion. As can be observed in Fig. 3, 68% of the participants consider Google Sites a useful or very useful tool.

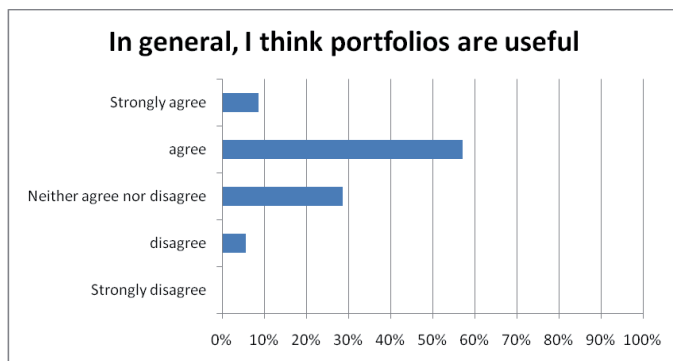


Figure 3. Google Sites as e-portfolio is useful.

An assessment was carried out on 68 e-portfolios, and we found, as can be observed in table II, that the skills most frequently developed by the students are: written communication 88%; oral communication 84%; decision-making 84%; and the competent use of information technology resources 83%.

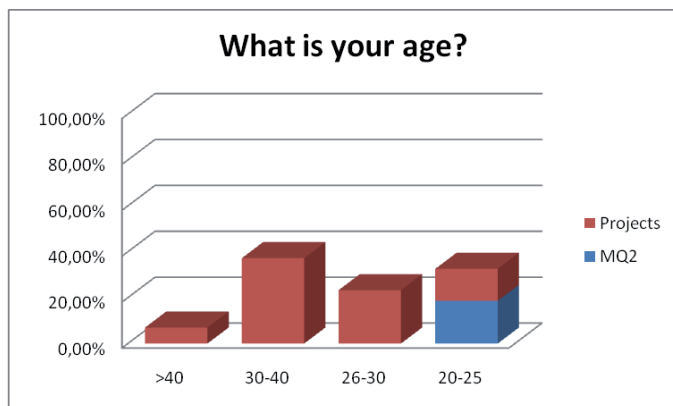


Figure 4. Student age.

From these statistics, the case of decision-making skills is the most outstanding. This result could have been as a result of 3 factors: 1) the student is in their last year of the degree; 2) the degree underway motivates students to good organization, comprehension and multi situation analysis (Enginyeria d'Organització Industrial). The subjects in which this activity was implemented aim at encouraging the student to apply those concepts acquired during the subject, to their professional lives with fluency and clarity. In addition to these factors, we can highlight the fact that the age of the students is varied, as can be observed in Fig. 4. This is especially noteworthy in the "Proyectos" subject which represents the largest group of participants in the study. In addition 54% indicated that it was easy for students to learn to operate the Google Sites e-portfolio system (Fig. 5).

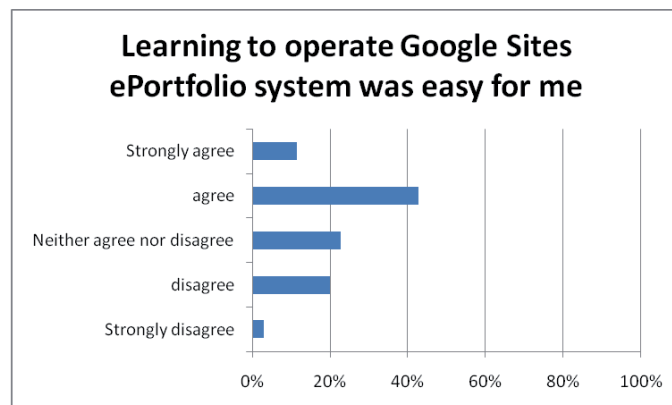


Figure 5. Google Sites was easy to use.

Specifically, what is required of the students is the implementation of the mathematical method that is best able to resolve real life problems in their professional lives, or simply the management, planning and development of a project in the most realistic manner possible. These two activities reinforce the consolidation of decision-making skills, given that the student must use his own reasoning process to develop the activities in question. A sound reasoning process, analysis and comprehension of the problem at hand, will enable the student to provide a solution for the problem by way of choosing the best strategy to be followed.

The mere fact of having to choose one direction or another helps to reinforce the spirit of critical analysis. This is one the most highly developed skills among the engineering degrees and through this methodology we have attempted to orientate the students towards enhancing their ability to reflect on the rationale for their decisions.

The skills of innovation and creativity, as with the sharing / collaboration of the e-portfolio, are among those that are least required of students. As we can see, it is precisely these skills which have scores of under 50%, following the application of the rubric. Creativity is a measurement of the design and accessibility of the e-portfolios and the student persecutions of the fact of sharing their knowledge with everyone else.

One possible explanation for this could be the low self-esteem and difficulties with reflection exercises that students may grow to experience. In [3] mention is made of the usefulness of this activity in helping them to improve their work and value it more highly prior to facing the real professional world. The article addresses, in addition, concerns surrounding the cases of plagiarism that have been experienced. This may be a reason as to why students decide against sharing with the rest of the world and may be a technique used to avoid it. It also raises the point of the difficulty for the students that are implied when having to perform a reflection and then share it.



TABLE II. RESULTS OF THE EVALUATION OF SKILLS BASED ON THE ESTABLISHED CRITERIA

SKILLS	%
AUTONOMOUS LEARNING	64.28
DECISION MAKING	84.20
CRITICAL THINKING	51.01
CREATIVITY AND INNOVATION	49.86
ORAL COMMUNICATION	84.17
TEAM WORKING (COLLABORATION)	47.17
ACCURACY IN INFORMATION RESOURCES USE	83.82
WRITING COMMUNICATION	88.04
SOCIAL RESPONSIBILITY AND SUSTAINABILITY	73.48

Concerning the evaluation of oral communication skills, within the teaching scheme, the e-portfolio provides an analysis of the presentations and videos produced by the student during the “Proyectos” subject. These videos are essentially a deliverable that students can provide within the e-portfolio.

With respect to the remaining skills such as the competent use of information resources and technology, measurement is carried out based on the correct use of bibliographical citations, the reliability of internet links given and the quality and interpretation of the information sources used. The skill of sustainability and social responsibility is measured according to the sharing of knowledge and the student’s contribution to the development of the academic year. The UPC is currently changing the class teaching model for one which is more cooperative and collaborative; placing the student at the centre of attention throughout the academic year.

Lastly, the written communication skill is measured by the structure and format of the subject content as well as the content in and of itself (Table 1).

In summary, herewith are some of the reflections that can be found in the e-portfolios of the students, which give an indication as to how they have rated this experience:

*“...Moreover, although my English was not very good at the beginning I’ve practiced enough with e-portfolio acquiring a better level.*

*I guess that this tool can be used in many other subjects in the same way we did in MQ2.*

*Personally, I really liked this tool. On one hand, it gives me the chance to learn English, and additionally, I have learned a new method for organizing a web page.”*

*“...The e-portfolio has helped me to take a quick and good look at my English skills. But I think that the e-portfolio should not be related to this subject. “*

*“I would say that as a working tool is very useful and I would recommend it. It is so that I consider that the knowledge acquired by learning how to write an e-portfolio can be considered a valuable thing because I apply it into the real life. I also notice that some enterprise workers use e-portfolio as a presentation letter. In summing, the e-portfolio as working tool has great potential and therefore it can be applied on a large number of real life situations”*

## V. CONCLUSION

The teaching scheme implemented in these two subjects has provided us with quantitative and qualitative data on how professors can identify the degree of acquisition of skills such as communication, synthesis and analysis etc. during the creation process of the e-portfolio. This is done by way of established criteria which allow for the follow-up of the skill output and development of the student.

These results can be contrasted with the qualitative evidence compiled in the article by Chun [23] on the use of the e-portfolio as a tool which facilitates the accomplishment of learning goals in so much as the student must collect, evaluate and reflect on their own deliverables. This evidence, (work, reflection, skill implementation,...) that is compiled by the e-portfolio enables us to determine the degree at which those skills have been developed and acquired throughout the student learning process. Moreover, we can see that the students use three different means of learning, as defined by Kolb, through the use of the e-portfolio. For example, the student applies a specific area of knowledge acquired during the course of a particular subject (concrete experiences, self-study), carries out reflection and personal criteria as they create the e-portfolio supported by the case/project they are developing at the time (abstract conceptualization – critical thought), and explores and develops a logic (experimentation and decision-making). These three types of learning are reflected in the deliverables that can be observed in the e-portfolio as with the result of skill-developing (decision-making; 84%, critical thought; 51% and self study, 64%).

It must also be noted that the evidence gathered in the e-portfolio of this teaching scheme is the fruit of a continuous feedback process that students receive together with other students and/or the professors, during the process of creating the e-portfolio. At this point is important for students to share their e-portfolio with the rest of their peers (47% of the actually do this). What is of equal importance however is to take into consideration the need for measuring the impact that the e-portfolio has during the student learning process; the importance of which can be deduced from the survey. It has been noted that 33% of professors use collaborative tools in the

classroom and that 77% perceive the utility of these tools as teaching methodologies for the development of skills in students.

In addition to the fact that these activities have the limitation of having been implemented in only two subjects, the great potential of this methodology could be released as a complementary tool for the evaluation of skills as stipulated by universities.

In the light of the results obtained, we view this experience, as being a very positive one and also see its usefulness as a cyclical follow-up tool. On a personal level, it can serve as a summarized curriculum vitae that students could present to display their abilities, although time and effort must be invested in order to attain maximum yield of this tool. An example of this is when different professors need to be contacted and organized in order for them to complement the activities included in the document.

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